Time and Tide

THIS weekly journal has been running a series of articles on the population problem. Professor Raymond Pearl led off with a brief sketch of the history of the study, an outline of the salient problems, and an account of his own experiments upon the biology of population growth. Professor Edwin Cannan followed, expressing a belief that contraception controlled population growth, and a hope for smaller populations. Dr. F. A. E. Crew emphasized that "reproduction is merely incidental to marriage," and made an appeal for selective breeding.

Mrs. Margaret Sanger expressed the belief that the qualitative aspect of the population problem is now taking precedence of the quantitative. Dr. Letitia Fairfield's plea, "The Need for Birth-Controller Control," is more amusing than sound. Besides asking the usual question, "Who are the right people to breed, and who the wrong?" she implies that the dependent poor are desirable, and that mental deficiency is decreasing. Her figures for the latter simply refer to M.D.'s *under control* in London. She also definitely states that crime is decreasing, which is not correct (*vide* Carr-Saunders and Caradog-Jones, *The Social Structure of England and Wales*). There are other inaccuracies, large and small.

E. M.

World To-day

May.—*Birth Control or Race War,* by H. K. Norton, is a survey of the international problems which will arise as such nations as Italy and Japan expand and demand more land. An attempt is made to discover the ethics of the situation on the principle that "Population should be adjusted to territory and not territory to population."

E. M.

CORRESPONDENCE

NATURAL SELECTION—A CORRECTION

To the Editor, Eugenics Review

SIR,—There appeared in January, 1927, in this *Review* an article by me on Natural Selection, which, I regret to say, I now perceive contained an illogical argument, though luckily the conclusions arrived at still seem to me to be correct. My error depended upon fixing my attention on the question whether a particular individual in a differentiated series of organisms belonging to the same species was above or below the average in regard to the quality under consideration, and in not observing that when any two individuals, for example, are competing in the struggle for existence, the elimination of the inferior organism would be an advantage to the species however much both of them might be below the average. Had I now to write that article again, I should omit most of page 287, and substitute the following paragraphs, which I hope you may find space to insert. I think they will be intelligible standing alone:

In order more fully to meet this point as to survival value, it is necessary to consider more in detail how natural selection can act on such a differentiated series. We have seen that qualities are generally dependent on several genetic factors, and that the degree of variability of such qualities is limited by the frequency of the occurrence of mutations on the one hand and by the pruning effect of natural selection on the other. The fur of animals, for example, may be too thick in summer and too thin in the winter, a compromise being slowly established by nature. Thus far we have, however, only considered each *quality* of the organism as if it could be studied without reference to other qualities. Take the colour of the blood, for example, and it seems probable that if a mutation were to occur tending to cause a considerable change therein, this would be fatal or gravely injurious to the animal; because it would be the result of a change of chemical composition which might have serious effects on the brain or lungs. Such injurious mutant qualities would not be passed on to succeeding generations, and the action of natural selection in such cases would therefore result in the range of variation of the quality in question being kept within narrow bounds. In fact, the narrower the differences between one quality and any other independently varying quality, beyond which such differences become seriously harmful, the less will be the amount of variability found to exist in that quality. And it is obvious that the less the variability, the slower will be the action of natural selection; for not only will each step in advance necessarily be small when the variability is small, but the greater the similarity between the competing organisms in regard to any quality, the more likely will it be that survival will be decided with reference to some other quality.

But these will not be the only reasons why natural selection will be slow when several qualities have to be simultaneously modified in order to maintain a certain harmony between them. When this is the case, natural selection will, as we have seen, always prevent any marked disharmony from frequently making its appearance. Nevertheless, a considerable change might take place in both qualities with advantage to the organism, if the change was simultaneous and harmonious. Fur might become thicker if at the same time it became lighter in colour; and thickness and colour might depend on separate or independent factors. In such cases the survival value of all the individuals in a competing group might be estimated by a consideration of both qualities; and when survival was decided by these qualities, the individuals worst endowed in both respects would be eliminated. Progress would thus be made in both qualities; but this improvement being shared between two qualities, natural selection would only act with about half the rapidity as if only a single quality with the same degree of variability were in question. If natural selection had, as it were, to take into account three such independently varying qualities, it would proceed with only one-third of the pace. The greater the number of qualities which had to be kept in harmonious relationships with each other, the slower must be the action of natural selection.

We may, therefore, conclude that the rate at which evolution can take place is subject to two limitations. The change in any quality must be slow in proportion both to the rigidity of the physiological or utilitarian tie which binds it to any other independently varying quality, and to the number of such other qualities to which it is thus bound.

It may perhaps here be noted that in each succeeding generation the collection of genes thus favoured by natural selection would be scattered throughout the group, the favourable combination thus quickly disappearing; but it is equally true that each such selection would result in a slight increase in the proportion of those genes which, when united in one individual, would produce an organism especially likely to survive in the struggle for life; and that this would lead to a steady but slow increase in the proportion of such individuals appearing in future generations. In other words, the regression to the mean amongst the immediate offspring of any selected group of parents must be regarded more as a wider distribution than as a loss to the race of the superior qualities of those parents. The resulting evolutionary process may be, no doubt, extraordinarily slow, but it will be none the less sure. And the number of individuals that can survive being limited, the less likely selection is to act on one quality, the more likely must it be to act on others. It follows, therefore, that an advance may be simultaneously in progress with regard to many different groups of qualities, thus resulting in a continuous improvement in the adaptation of the organism to its surroundings in many respects. An evolutionary process under the guidance of natural selection should, in fact, seldom be compared to an army beginning its advance by throwing out a few skirmishers in different directions far to the front, whilst it may generally be likened to an invisibly slow forward movement on a wide and uniform front with the leading ranks but little in front of those following behind.

Later on in the article I should have inserted the following paragraph:

The following are some of the qualities or characters in regard to which the physiological limits of variability seem to be likely to be most restricted and natural selection proportionately slow in its action: General mechanism of the whole organism (differences between plants and animals, or between fish and mammals). General position of the chief organs of the body (brain, heart, lungs, etc.) Succession of different stages of development. Internal colour. Temperature of blood, etc. On the other hand, the following qualities are examples of such as might vary independently of other qualities, making natural selection comparatively quick in its action: Scale of whole organism (height of man). Shape of external organs (horns, ears, tail, hair, leaves). External colours (flowers, buds, butterflies). Do not these two lists represent broadly the kind of differences which differentiate the larger divisions into which organisms are grouped by naturalists, and those which differentiate species?

Yours faithfully,
LEONARD DARWIN.

To the Editor, Eugenics Review

SIR,—In an article in your April issue, Mr. W. T. J. Gun virtually states that no eugenist has ever proposed restrictions on "breeding freely," except in the case of the "hopelessly inferior." Have not Major Darwin and other leading eugenists proposed such restrictions for the relatively inferior also? As practically all the more valuable couples will limit their families, eugenists must desire that the less valuable couples will do likewise. The Malthusian fact should be appreciated that, in long-settled countries, the food-growing and food-buying capacities are increased so slowly that the average number of children per marriage can hardly exceed three if all are to be adequately fed. It should therefore be a rule that no couple in the poorest third, at least, of a population should have more than two children. Moreover, this rule should be endorsed by the League of Nations, because the wider its observance the better would be the prospect for peace as well as for prosperity and race improvement.

Unless there be reduction of numbers by emi-